REMARKS

In the Official Action mailed on **22 October 2007**, the Examiner reviewed claims 1-35. Claims 1-35 were rejected under 35 U.S.C. § 103(a) based on Zhang et al (USPub 2003/0061587, hereinafter "Zhang"), and Shi et al. (USPN 6,519,760 hereinafter "Shi"), and Pierrat et al. (USPN 6,453,457 hereinafter "Pierrat").

Rejections under 35 U.S.C. § 103(a)

Independent claims 1, 12, 23, and 34-35 were rejected as being unpatentable over Zhang, in view of Shi, and further in view of Pierrat. Examiner acknowledges that Zhang does not disclose generating intensity gradients which include both magnitude and angle. Nevertheless, Examiner avers that Shi and Pierrat substantially disclose the generation of an intensity gradient, which substantially includes both magnitude and angle.

Rejections based on Shi

Examiner stated that:

"Shi et al. substantially teaches the steps of performing a model-based simulation on the layout to generate intensity gradients along edges of features in the layout, ….(*see fig. 1, 3, 5, and 12 and col. 8, lines 24-64, col. 3 lines 52-54*)" (see office action, page 4, ll. 5-8).

Applicant respectfully points out that Figs. 1, 3, 5, and 12 in Shi do not indicate generating intensity gradients which include both magnitude and angle. Although these figures include certain angled components, such as the θ and ϕ in Fig. 1, θ_0 in Fig. 3c, and the 30° in Fig. 12, none of these angles refers to the angle of the intensity gradient. Note that the α and β in Fig. 5 are representing 2-D coordinates instead of angled components. Applicant respectfully points out that the θ and ϕ in Fig. 1 are simply **angular coordinates** for illustration the definition of a coordinate system and has nothing to so with an intensity gradient angle (see col. 6, ll.18-25 and Fig. 1 of Shi). In addition, the θ_0 in Fig. 3c indicates the **illumination angle**, which is the angle between the illumination direction with the normal direction of the mask surface (see col. 6-7, ll. 66-15, and Fig. 3 of Shi). Applicant also like to point out that the 30° in Fig. 12 of Shi indicates 30-degree QUASA that refers to a quadruple pattern in which the 4 poles are segments of an annulus, and each subtends an angle of 30 degrees with the center of the annulus (see col. 12, 1-4 and Fig. 12 of Shi).

Furthermore, col. 8, lines 24-64 of Shi only discusses that forbidden pitch regions may exist under certain illumination conditions including the pitch, the **illumination angle** and the numerical aperture. Nowhere in this text is the intensity gradient mentioned.

Similarly, col. 3, lines 52-54 merely mention "*determining illumination intensities for a given extreme interaction pitch region over a range of illumination angles* (see col. 3, ll. 52-54 of Shi)." Nowhere in this text is the intensity gradient mentioned.

Rejections based on Pierrat

Examiner also stated that:

> "Pierrat further teaches the generation of an intensity gradient, which substantially includes both magnitude and angle (*see Pierrat et al. fig. 4-6*)" (see office action, page 4, ll. 5-8).

Applicant respectfully points out that Figs. 4 and 5 of Pierrat illustrate how dissection parameters can be derived from the proximity effects model output. In Fig. 4, the **amplitude of model output** determines if a feature is to be printed (see col. 10-11, ll. 52-4 and Fig. 4D). Note that Fig. 4D shows the **model amplitude** along one edge. Fig. 5 demonstrates the selection of dissection points and the derivation of dissection parameters from a profile model output (see col. 11, ll. 10-13). The **first and second derivatives of the model amplitude** profile are used to select the dissection points (see col. 13, ll. 40-43, col. 14, ll. 16-18 and Figs. 5C and 5D of Pierrat). Note that the first derivative of the amplitude profile is different from the intensity gradient. The first derivative of the amplitude profile is a measure of the slope of the profile (see col. 12-13, ll. 67-1 of Pierrat), which is a **scalar** and does not include an angle. However, the gradient of the intensity is a **vector** that includes both the magnitude and the angle of the intensity change (see par. [0047] of the instant application). Fig. 6 of Pierrat merely shows a test pattern and the corresponding model amplitudes. Nothing in Pierra mentions generating intensity gradient that includes both the magnitude and angle.

In contrast, the present invention teaches generating a segmentation for edges in the layout based on the **2-D intensity gradient** which includes both magnitude and **angle** to determine dissection points (see [0007] of the instant application). Obtaining both the magnitude and angle information of the intensity gradient is advantageous because either the magnitude or the angle can be used to decide dissection length and in the case of a 2-D feature, both of them may be used together (see pa. [0050] of the instant application).

There is nothing in Zhang, Shi and Pierra, either standing alone, or combined, that discloses or suggests **generating a segmentation** for edges **based upon the 2-D intensity gradients** including both magnitude and angle.

Accordingly, Applicant has amended claims 1, 12, 23, 34, and 35 to clarify that embodiments of the present invention generate a segmentation based on the 2-D intensity gradient which includes both amplitude and angle. These amendments find support in par. [0047] of the instant application. No new matter has been added.

Hence, Applicant respectfully submits that independent claims 1, 12, 23, and 34-35 as currently amended are in condition for allowance. Applicant also submits that claims 2-11, which depend upon claim 1, claims 13-22, which depend upon claim 12, and claims 24-33, which depend upon claim 23, are for the same reasons in condition for allowance and for reasons of the unique combinations recited in such claims.

CONCLUSION

It is submitted that the present application is presently in form for allowance. Such action is respectfully requested.

Respectfully submitted,

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